Orbit error due to time variable gravity and impact on mean sea level trend estimates and tide gauge calibration

introduce 4 Items from poster:

1) TVG important to POD, with several recent competing models

1) impact TVG error on MSL

1) impact TVG error on calibration

1) SLR+DORIS reduced dynamic orbit sensitivity to TVG error
1) Orbit accuracy using the old TVG model (stdtvg) progressively degrades compared to 6 orbits with recent TVG modeling.
2) Jason-2 TVG orbit error impact on sea level – manifest as periodic signals and regional trends

Spectral analysis of std1007-jpl11a radial differences over fixed geographic locations (118-day signal removed)
2) Jason-2 TVG orbit error impact on sea level – manifest as periodic signals and regional trends

Regional trends (mm/yr)

std1007-test orbit radial difference linear rates (mm/yr) estimated July 2008 – August 2011 after removing annual, semi-annual, and 118-day terms.

Images:
- jpl11a
- red_tvg4x4
- gdrd
- red_grgs50x50
2) example of TVG orbit error potential impact on regional sea level trend analysis (mm/yr)

Mean radial (std1007-test) orbit differences over N. Atlantic
(Latitude: 30-60, Longitude: 300-360 degrees)

- tvg4x4 = -0.13 mm/yr
- jpl11a = -0.03 mm/yr
- gdrd = -1.15 mm/yr
3) Tide gauge calibration sensitive to Jason-2 TVG regional trend orbit error

<table>
<thead>
<tr>
<th>Estimated linear rate (mm/y)</th>
<th>Orbit</th>
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<tr>
<td></td>
<td>std1007</td>
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<tr>
<td><strong>weighted</strong> altimetry-tide gauge calibration estimate over 64 tide gauge sites (see Note below)</td>
<td>-1.00</td>
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<tr>
<td><strong>un-weighted</strong> mean orbit differences over 64 tide gauge sites (test-std1007)</td>
<td>0.00</td>
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<tr>
<td><strong>un-weighted</strong> altimetry-tide gauge calibration approximation</td>
<td>-1.00</td>
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Note. Gary Mitchum’s latest **weighted** altimetry-tide gauge residuals mean for the std1007 orbits Jason-2 cycles 1-182 (see Beckley et al., 2013 poster, Global CAL-VAL session).
4) The SLR+DORIS reduced-dynamic improves consistency between the grgs50x50 /tvg4x4 orbits as shown in the reduction of power for the periodic signals. However ....
J2 dynamic orbit (grgs50x50-tvg4x4) radial difference linear rates (mm/yr) estimated July 2008 – August 2011 after removing annual, semi-annual, and 118-day terms.
J2 reduced-dynamic orbit (grgs50x50-tvg4x4) radial difference linear rates (mm/yr) estimated July 2008 – August 2011 after removing annual, semi-annual, and 118-day terms.
Conclusions

1) Recent TVG models progressively improve Jason-2 orbits over the standard approach used for the previous Measures std1007 and GDRC orbits.

2) TVG orbit error manifests largely as an annual signal and in regional trends. All recent TVG models show significantly different regional trends.

3) Tide gauge calibration is sensitive to TVG regional trend orbit error, however tide gauge data can probably not be directly used to evaluate TVG models.

4) SLR+DORIS reduced-dynamic approach does not eliminate TVG regional trend error at the level of differences seen between competing TVG models.